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Beam Dynamics Simulation of Photocathode RF Electron Gun at the PBP-CMU Linac Laboratory

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Photocathode RF electron guns are widely used at many laboratories because of the high quality of the produced electron beams. By using a short-pulse laser to induce the photoemission process, the electrons are emitted with low energy spread. Moreover, the photocathode RF guns are not suffered from the electron backbombardment effect, which can cause the limited electron current density. In this study, we aim to develop the photocathode RF gun for the linac-based THz radiation source. The gun consists of a one and a half cell S-band RF cavities with a maximum electric field of about 60 MV/m at the full cell. We study the beam dynamics of electron traveling through the electromagnetic field inside the RF-gun by using the particle tracking program ASTRA. In addition, the laser and beam properties are optimized for low-emittance beam generation. The solenoid magnet is applied for beam focusing and emittance compensation. The proper solenoid magnet current is then investigated.

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